THE COASTAL TABLELANDS AND STREAMS OF NEW SOUTH WALES.

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(Six Text-figures.)

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Historical Introduction.

The use of distinctively physiographic methods in New South Wales is virtually confined to this century, but modern conclusions were foreshadowed and influenced by earlier work: Berry (1822) outlined the structural features of the Sydney region and many surface relationships; Clarke (1853, 1860, 1875, 1876) devoted much attention to stream origins, valley formation and denudation generally; Thompson (1869) described erosional features in the Goulburn district, and Wilkinson (1882) summarized the topographic development of the highlands. The natural approach for observers was from the coast, so Berry (1825), Dana, Jukes, Strzelecki and Wilkes (between 1845 and 1850) were impressed by evidences of coastal movement, and sought to explain the precipitous faces of plateaus fronting the ocean by faulting, and submergence of downthrown areas. In 1845 Murchison referred to the eastern highlands of Australia as the "Cordillera" on the ground of geological resemblances to the Urals, and Wilkinson (1882) continued the term, describing the cordillera as being originally a range of upheaval whose sides had been shaped into deep valleys. He considered that its highest points had probably not been completely submerged since the beginning of the Mesozoic era, and postulated a Tertiary subsidence of the order of 4,000 feet over the eastern part of the continent to allow the development of the various sediments of that age now found in the highlands. So far as external relationships were concerned, Clarke held the Australian Cordillera and the New Zealand arc to be similar anticlines separated by a trough, and to be comparable with the ridges and inter-ridge valleys of such alluvial goldfields as Lachlan River.

Towards the end of the century, David established the basis for modern discussion by giving further evidence of coastal movement (with Etheridge, 1890; with Etheridge and Grimshaw, 1896*b*) and by proving the nature of the eastern slope of the Blue Mountains (1896*a*, 1902). In the present century the study of physiography as such was introduced by E. C. Andrews, who applied the conclusions of North American workers to Australian problems and also contributed to the theory of the subject; his principal writings dealt with the Queensland coast and the eastern plateau (1902), New England (1903*a*, 1904*a*, 1905, 1912, 1914), the Blue Mountains (1903*b*), Physical Geography of New South Wales (1904*b*), New Zealand Sounds (1906), floods (1907), the work of gravity streams (1909), the geographical unity of Eastern Australia (1910*a*), Yosemite (1910*b*) and erosion (1911), while certain professional papers contained physiographic references, especially those dealing with Hillgrove (1900), Kiandra (1901), Drake (1908), Forbes-Parkes (1910*c*), and Cargo (1915). Other papers recognizing similar principles were those of Jensen (1906, 1907), Sussmilch and Jensen (1909), Sussmilch (1909, 1911, 1914, 1923), Woolnough and Taylor (1906), Taylor (1907, 1910, 1911, 1923*a*, 1923*b*), and Hedley (1910, 1911). These all had certain aspects in common; they adopted the idea of base-levelling, stream change by dynamic action, the interpretation of surface history by the study of land forms, and a time scale based on the physiographic position of Tertiary drifts and basalts, and all had affinities with conclusions of the past century in respect to coastal faulting, the cordillera, and the uniformity of movement in the eastern part of the continent.

Earlier observers postulated extensive faultings because of the precipitous coast and the sharp fall from a narrow continental shelf; later, Taylor held similar views because he considered that streams rising near the coast and flowing away from it (e.g., Nepean tributaries) are abnormal, and must have been balanced in the past by a further system to the east, where the sea is now; he also required the suggested land mass as a premise for his views on the diversion of former westerly and meridional drainage to the present east coast. This gives a connection with the idea of the "cordillera", for if that feature be conceived as a meridional anticline, "the general east and west trend of the coastal streams shows consequent drainage attendant on the seaward slope of the upland during previous elevations" (Andrews, 1902, p. 180), and meridional streams require to be explained as "subsequents" due to the expansion of original "consequents" (Andrews, 1902, 1903*b*, 1905), by meridional folding or faulting attendant upon uplift (Hedley, 1911; Taylor, 1911, 1923), or by diversion through block faulting in special cases (Sussmilch, 1909). At any rate, the idea of the Cordillera involves a special explanation for the meridional streams, and has helped towards the interpretation of many positive topographic features as being of tectonic origin associated with the most recent (Kosciusko) warpings. This view regards the Main Divide as being essentially an anticlinal crest, and higher ridges parallel to it have been interpreted as former anticlinal divides, as in the case of the heights of the Macleay basin (Andrews, 1903*a*, pp. 205–206), although the effect of resistant rocks in the preservation of such high features has also been noted (*ibid.*, p. 196). This idea of moving anticlines was carried to its greatest extreme by Taylor (1923*b*), who supposed one of them to have existed at a considerable height where the Sydney coast is now, and to have subsided as the wave crest progressed westward to form the existing Main Divide (at 3,500 to 4,000 feet).

With respect to the question of unity or uniformity, it may be noticed that Murchison (1845), Clarke (1876), and Wilkinson (1882) had the idea of uniformity of structure and process in the whole of eastern Australia, and the last-named envisaged a general rise or fall of much the same magnitude throughout the length of the highlands (pp. 52–59). Andrews extended the idea (1910), especially on the basis of widespread Tertiary peneplanation and subsequent differential uplift in which the region had acted as a unit, although he recognized moderately high relief in central New England following post-Cretaceous uplifts (1904, pp. 292–293): similarly, Reid (1926) ascribed considerable relief to eastern Queensland throughout the Tertiary period, and Craft (1932, 1933) regarded the plateau of south-eastern New South Wales as having been relatively high over a similar period. This emphasizes Andrews' (1914) conclusion that Tertiary surfaces were incipient peneplains not involving complete reduction, and puts the master peneplanation of the region back to late Palaeozoic or early Mesozoic times, with decreasing age going northward, and some apparent diversity of features caused by subsequent folding in Queensland as a variant of the gentle warping experienced elsewhere.

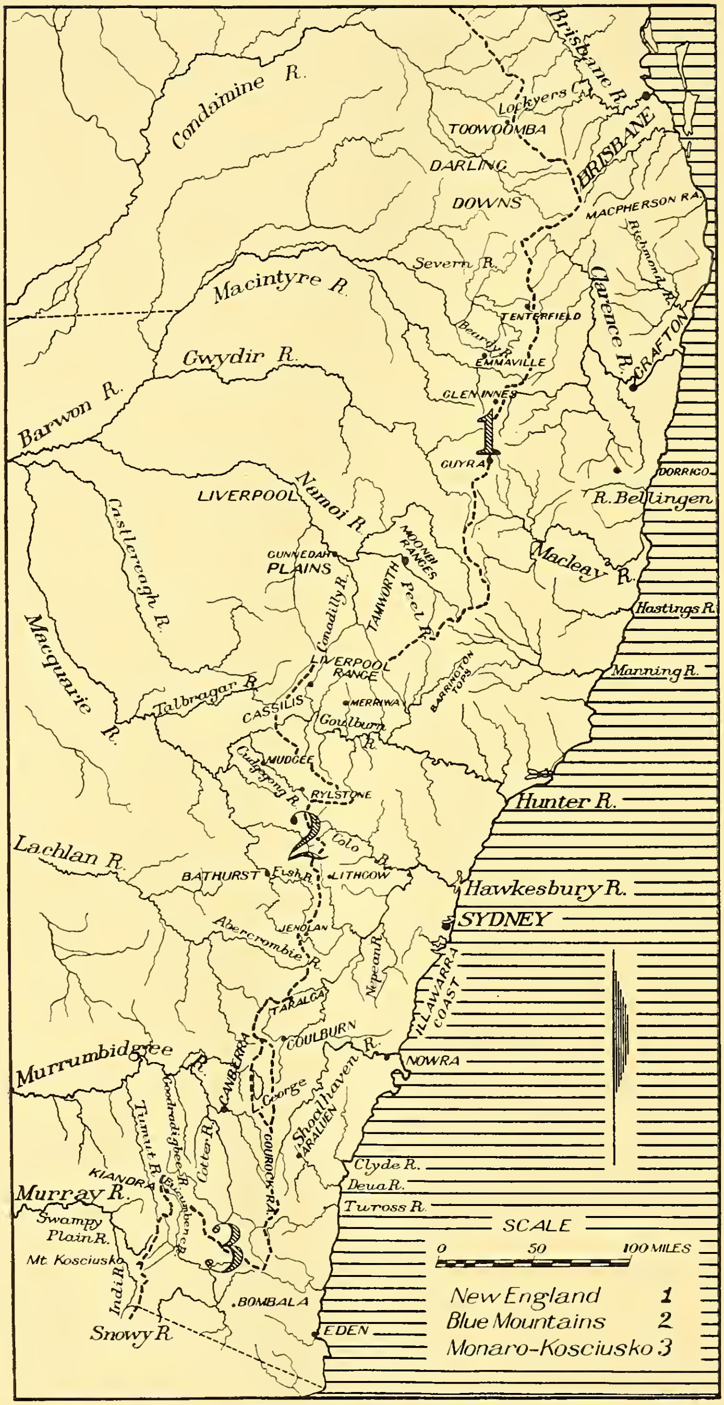
However, the most distinctive features of modern thought are the recognition of a peneplain now forming the principal surface of the plateaus, and the theoretical conceptions associated with it. Thus Sussmilch (1911, p. 144) writes, "The surface of the peneplain is not flat, but is traversed in most places by a network of broad, shallow, mature valleys, ranging from 150 to 300 feet in depth", which are ascribed to the influence of a slight uplift (p. 146); David (1932, p. 172) speaks of the same feature as having been ". . . . one of the most perfect peneplains imaginable; the slope of the land seawards being so slight as barely to suffice for any run-off after rain", and hills rising to similar heights above the plain surface in various localities have been referred to as relics of older regional peneplains (e.g., Andrews, 1903*a*, pp. 216–217; Sussmilch, 1909, pp. 335–344), without reference to their distance from the various divides. From this it will be seen that the peneplain was conceived as a virtually horizontal surface, and that successive peneplains had a generally similar form.

Now the present highlands offer considerably more variety of surface features than this may indicate, but on account of the (supposed) general morphological similarity of higher and lower surfaces, and their frequent separation by steep slopes or rugged falling country, it has been inferred that a former common surface has been broken up by block faulting and differential uplift, and that the bounding slopes of the higher blocks are fault scarps (Sussmilch, 1909; Andrews, 1910*a*). It must be remembered, however, that most high features are near stream heads, or are composed of resistant rocks; that "pre-fault" surfaces preserved by basalts show considerable local relief in many districts, ranging from 700 to 1,400 feet in restricted areas without disturbance through more recent uplifts, and that certain of the high blocks are bounded by normal erosion escarpments (e.g., Shoalhaven, Craft, 1932), so an examination of plateau topography begins without any preliminary assumption of extensive faultings.

Summing up, it has been found that certain ideas have been inherited from early studies, namely, those of extensive coastal faulting, the origin of the eastern highlands and the Main Divide in an anticlinal fold, and the uniformity of process and movement in the history of the existing surface. Distinctively modern conceptions are those of stream rearrangement by dynamic or tectonic action, the formation of an approximately horizontal surface near sea-level, and its elevation and breaking up to form the modern plateaus. The present work bases no conclusions on the grounds of possible coastal faultings or movement; it regards the Main Divide as a rather accidental feature of essentially non-tectonic origin, and the river systems as having been stable during the present physiographic record as the result of comparatively quiet evolution. A description of surface features is attempted from a similar viewpoint.

Topography.

Preliminary.—The plateau region consists essentially of three low domes—New England, the Blue Mountains, and Monaro-Kosciusko—which are separated from more northerly highlands and from one another by the Darling Downs, Cassilis, and Lake George areas respectively. The middle part of each mass, to a width of 50 miles from east to west, consists of a high plateau with streams



Text-fig. 1.—Locality Map of the Region; the Main Divide is shown by a heavy broken line. Names omitted from this map will be found on Text-fig. 6.

flowing considerably above sea-level: on either flank is a zone up to 50 miles in width in which the streams fall abruptly towards sea-level, through gorges at first, and then by way of widening valleys and plains. The major gaps of Darling Downs and Cassilis slope away gently on either side, but there is no break in the coastal heights east of Lake George, and streams flowing westward (e.g., Lachlan River) from its vicinity pass through canyon sections. Beyond the limits of the highlands are inland plains on the west, and the sea coast with irregular, narrow plains on the east.

There is some variation of surface appearance in going from north to south: thus the coastal slopes between the Queensland border and Hunter River have rounded forms and many hills more or less isolated from the plateau mass; the appearance of roundness is helped by forests and brush common to the region. On the other hand, the coastal fall in the country south of the Hunter consists mainly of solid ridges preserving even crests, with few isolated hills. In the high plateau about Kosciusko all features in the region of heavy rainfall are rounded, and on the western foothill slopes of Monaro-Kosciusko there is a tendency towards isolated hills and concave slopes. However, a general rule applies to the head parts of all the canyon sections, namely, outlines are rectangular, with sharp breaks of slope, and with uniform slopes on the canyon sides.

Exterior and Interior Forms.

In the higher plateaus and their slopes two broad types of scenery are commonly presented. In the first, the whole countryside appears as an almost horizontal plain, varied by occasional hills, and with any higher land at a distance, generally on one or two sides only. In the second, there are plains of greater or less extent terminated by superior walls or ridges, and generally appearing quite enclosed; the ridge summits give the impression of a continuous surface when viewed from a point in or above their plane, but actually the whole ridge features only occupy 10% to 25% of the locality, except where they expand into plateaus, and their boundary is purely arbitrary. For the present discussion, the terms "exterior" and "interior" will be applied respectively to the types: in the former, the whole surface may be considered as a unit without notable break of slope, whether it is plain or undulating, while the latter depends on the major break of slope in passing from central plains to bounding ridges, and on the existence of well-differentiated planes inclined to one another. In addition, the narrow canyons and the conical peaks of Barrington Tops at the head of the Manning, Hunter and Peel Rivers are distinct scenic features. The principal occurrences of the two main types may be summarized:

(*a*) *Exterior Forms.*

- (i) Elevated Peneplains: New England; tableland of upper Macquarie-Abercrombie Rivers; Kosciusko plateau; Monaro peneplain.
- (ii) Surfaces of sub-horizontal Rocks: Plateaus of Hawkesbury and eastern Shoalhaven; part of Clarence basin.

(*b*) *Interior Forms.*

- (i) Ridge and Plain: Lower New England, Cassilis, and Liverpool Plains; Goulburn-Lake George; Shoalhaven; Murrumbidgee; Federal Territory; Western Monaro; Bathurst Plains.
- (ii) Plateau and Plain: Hunter Valley; valleys of western Hawkesbury (Kowmung, Cox, Colo, lower Wollondilly); coastal strip.

(a) *Exterior Forms.*

(i) *Elevated Peneplains.*—The term "peneplain" is used to denote those surfaces in which erosion has been carried so far that original high watersheds have been almost completely reduced, leaving occasional isolated hills or low ridge lines. The land surface is composed of gently undulating country of low relief, or of gently concave plains; the summit plane appears to be quite horizontal, but on the falls from the central plateau mass it may be inclined at angles of 1° to 3°. The characteristic feature of the scenery is an even skyline, which gives an appearance of horizontality that is often deceptive, as changing distance and perspective mask undulations or gradual slopes over long distances. The lower portions of the surface consist of valleys or plains, which are alluviated, and support meandering normal streams that have flood terraces up to a mile in width. Once the steep headwater portion of a stream is passed, a gentler section is found at an almost constant range of altitude for each district, and with a uniform depth below corresponding ridge crests. This is best shown on a large scale in the Macleay basin, where radial streams and ridges fall at a uniform rate towards a common centre over a distance of 20 miles. The continuity of the upland features is interrupted by canyons of varying depth as the plateau margins are approached, and the old peneplain surfaces are preserved in the ridge crests and gentle upper slopes, until they become dismantled in the general fall to lower country. There are some exceptions to this rule, as portions of relatively undissected plateau come near the coast at intervals throughout its length.

The principal areas comprised in the type are the upper surface of New England above 3,000 feet, or above 2,000 feet to the north-west of Tenterfield; the plateau of the southern Macquarie-Abercrombie-Jenolan region (mainly 3,000 to 4,000 feet); the country immediately west of Lake George (above 2,000 feet); the Kosciusko-Kiandra-Upper Murray plateau (4,500 to 7,000 feet), and the Monaro district (2,800 to 3,500 feet). In places the valleys in the edges of these high blocks have been expanded into plains to form true interior features: chief among these are the valleys of the Gwydir, Namoi and Peel Rivers (Liverpool Plains), the Talbragar, Hunter, upper Murrumbidgee, and the Eucumbene-Snowy. Such features, rather than the major differences in summit elevation between the high-level peneplains, form the separation zones between the various plateau groups.

(ii) *Surfaces of sub-horizontal Rocks.*—These are usually included with the peneplains because slightly upturned edges have been bevelled off by erosion, but they represent a distinct scenic type. As a general rule, they appear to be within a few hundred feet of the original upper surfaces of deposition, but they have been deformed into a series of shallow basins with inward slopes of the order of 2°, which carry the surfaces from sea-level to a maximum altitude of 4,000 feet (near Lithgow). As with the elevated peneplains, there are no masses enclosing the features, which are of a regional character, but there are sharp rises from some edges to higher masses of the preceding class. Such edges are found in the north and east of New England, facing the Darling Downs and the Clarence basin respectively, and to the west of the Hunter-Sydney region, on a line extending from Mudgee to Goulburn. The topography of these areas is mainly controlled by elevation and rock character, because the bedding and joints of the rocks give series of horizontal and vertical surfaces, thus imposing a dominant convex profile in hill and valley sides, with minor cliffs at intervals.

and a tendency towards major cliffs in the lower slopes, especially where softer layers of rock are found. The skylines are very even, approximating closely to the horizontal, with a few minor irregularities where basalt flows or ancient monadnocks rise above the general surface. The major occurrences are on the Darling Downs (Queensland), in the Clarence basin, the Hunter-Sydney region, the upper Clyde, and the eastern Shoalhaven divides.

(b) Interior Forms.

In the type of exterior features, classification depends on the dominance of one surface: with interior forms, a surface much below those high features of the landscape is the criterion, and it is separated from them by a very marked break of slope. There is no firm line of division between the types, because increase of relief or geological differentiation tends to break up the uniform surfaces of the exterior class: thus the valleys of Moonbi Ranges (Tamworth) are interior features, with granite floors surrounded by metamorphic ridges, and some valleys of the Glen Innes region, in basalts, have a similar form. On the whole, however, the types are well differentiated, and the smaller interior features are localized. Two sub-types may be recognized, according to the nature of bounding highlands.

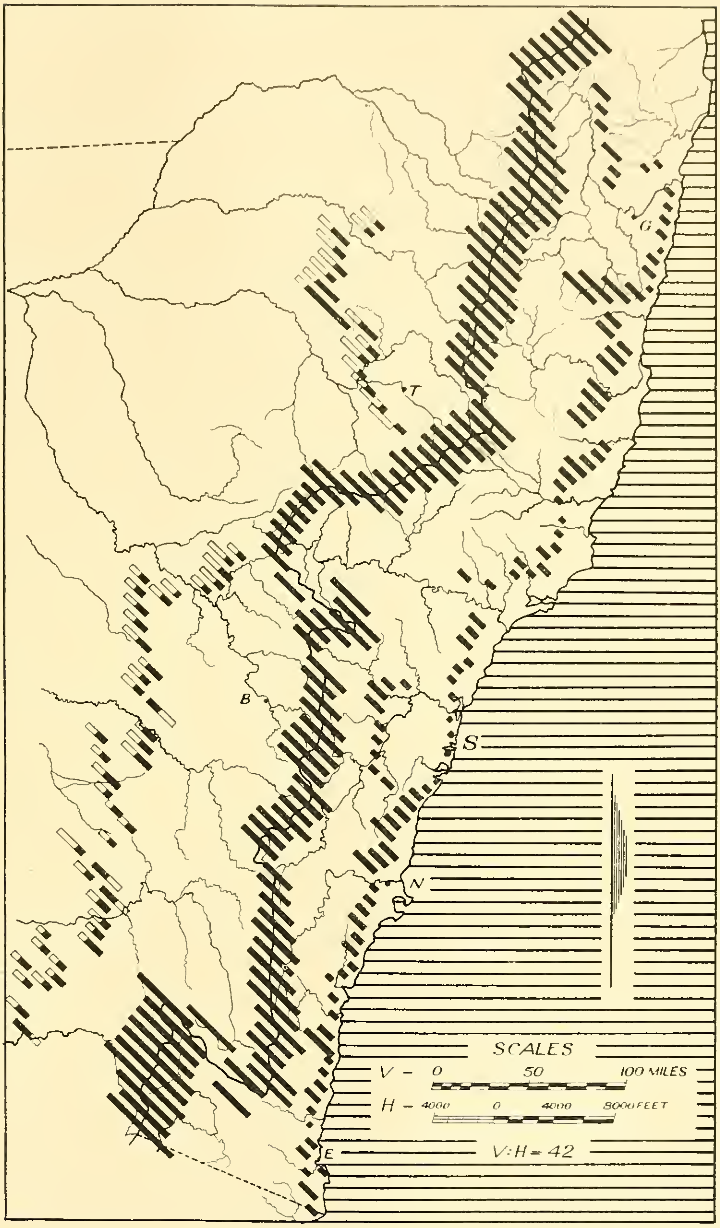
(i) *Ridge and Plain.*—This division is of great importance in the life of the State, as the plains furnish easy routes, and are highly productive. They are interrupted and partially enclosed at least by high ridges, which form up to 25% of the landscape. The ridge crests in any one district usually lie in a plane 800 to 2,500 feet above the lower features, and are of an undulating character. The slopes are steep, and are often rocky and forested, with angular values up to 60°, and rarely below 20°. The form depends on the nature of the local rock, but as the ridges are generally determined by the grain of the country and major joints, they tend to have straight edges and rectangular patterns. They rise steeply from the plains with only narrow foothill slopes, generally not exceeding a mile in width, and appear like steep coasts or islands rising from the sea. On the other hand, the enclosed plains are gentle and smooth, with slopes varying from 0° to 0° 30′ in any direction, and the streams usually flow in very slight depressions hardly below the general level. An exception to this latter rule is found on the southern side of Liverpool Range, where tributaries of Goulburn River pass to level valleys 500 feet below the basalt-sandstone plain, but mostly the flood plains of the streams are simply parts of the valley floor, which does not vary appreciably between the bounding ridges. Thus the valley of Conadilly River includes such an alluvial plain 20 miles in width.

This leads to another characteristic of the plains, namely, their alluvials. These are universal, and consist of an upper horizon of fine sand or silt, usually 5 to 10 feet in thickness, and a lower one of rounded pebbles of general thickness 3 to 6 feet where exposed, but in many localities the modern streams are still flowing over the old pebbles. The process of channel cutting is still going on, so the plains are exposed to two major actions—sheet flood erosion, and channelling. The principal occurrences of ridge and plain features are on the western slopes of New England (Liverpool Plains); the valleys of the Peel and Conadilly Rivers; the southern and south-west sides of Liverpool Range, leading to Mudgee and Rylstone districts; Goulburn; the Shoalhaven Valley; the Lake George-Canberra district; the headwater country of the Murrumbidgee; the basins of the Eucumbene-Snowy valley, and the upper parts of the Murray (Swampy Plain) valley. In the examples to the north of the Blue Mountains, the bounding ridges are generally horizontal lavas or sandstones: to the south, they consist of long, straight, narrow ridges, and of hill masses in the case of local basins of the head Murrumbidgee and Eucumbene-Snowy.

(ii) *Plateau and Plain.*—This type of scenery is almost confined to the margins of the Triassic sandstones of the Hunter-Sydney region. The higher bounding features are plateaus, partly of sub-horizontal sandstones and partly of older rocks, and the enclosed areas are undulating plains of some relief, generally up to 500 or 600 feet. The two surfaces are separated by cliffs, frequently precipitous, and are sharply differentiated; the characteristic break of slope between the bounding scarp and the lower plain obtains, and in addition there is another major break between the scarp and the upper plateau surface. It is usual to find the enclosed features divided into steps or terraces: there are series of such levels along the upper Cudgegong, Colo and Cox Rivers, the slopes from one to another being slightly roughened in the first case, and trenched by deep gorges in the third, while the Colo terraces are separated by unbroken cliffs. As opposed to these, the valley of the Hunter is close to sea-level, and has alluvial bottom plains in the narrower valleys above Singleton; below that town, the wider expanse of the valley is hilly and undulating, although there is also an expansion of the flood plains.

The development of limited interior features may be observed in Burragorang Valley (lower Wollondilly), where the valley floor attains a maximum width of two miles, half of which is alluviated. At Newton Boyd and Araluen, valleys of triangular plan are developed mainly in granites above major stream junctions, with sides from two to five miles long. In a similar class, perhaps, is the limited plain along the coast which is enclosed by high plateau on one side, and the ocean on the other. This occurs between Bellingen and Hawkesbury Rivers, and from the Illawarra Coast south of Sydney to the Victorian border: it is partly composed of alluvial or shore line deposits, and ends sharply against the eastern scarp of the plateau mass, with very limited extensions along the main rivers.

Plateau Scarps and Edges.—The main plateau scarps run north and south on either side of the highlands (Text-fig. 2). To the east, their front is well defined and continuous, but to the west the edge marked for the highlands is more arbitrary, owing to the gradual disintegration of the slopes. There is, however, a broken line of hills marking the eastern limit of the inland plains, or the western plateau margin, and a rather less continuous fall from the compact tableland to the nearest of the flanking valleys within the limits of the country of high relief. Thus the fall to the Murray tributaries in the vicinity of Mt. Kosciusko is 4,000 to 5,000 feet, that to Bathurst and associated plains from the Blue Mountains is 2,000 feet, and that from Moonbi Ranges (S.W. of New England) to the Peel Valley is 3,000 feet. In each case the plan of the edge is complex, and conforms to the principal drainage lines by sending branches along the main water partings. These slopes or scarps are not to be confused with the ridge features of the plateau surfaces, which follow the grain of the country, and are meridionally disposed. The granite ridges of New England and the granite and quartzite ridges of the Goulburn-Kosciusko region are typical of the latter, and are an integral part of the plateau surface: the immediate boundaries of the tableland, however, are features or surfaces distinct from either the plateau



Text-fig. 2.—Relief of the Main Divide and highland edges. The solid columns point inwards towards the heights of the Main Divide (middle columns), and show the elevation of plateau edges above their surroundings. The hollow columns towards the west show the elevation of the local bases above sea-level, but such a value on the eastern side is too small to be depicted. The difference between the outer columns (including the hollow) and those of the Main Divide shows the altitude represented by gentle regional slopes, while the hollow columns show the vertical distances through which the inland slopes fall to sea-level. This gives an idea of the relative importance of the main stages in the rise to the Main Divide.

or lower plains, and are consistently falling slopes whose average value is of the order of 20°.

From this it will be seen that the slopes east and west of the Main Divide are broadly divisible into two sections: an upper slope of the summit or crest plane whose angular value rarely exceeds 2°, and a steep lower slope delimiting the main plateau blocks, whose value depends on local circumstances, and may approach 45° in small areas. Northerly or southerly falls are less easy to define on account of the meridional elongations of ridges, which have irregular crests and abrupt terminations, as in the case of the extremities of Gourock Range, but the fall in high or low points of the landscape is of the same order as the gentler part of the transverse fall noted above, with breaks due to erosional scarps. Among the latter may be included the northern fall to Darling Downs (Queensland), the local scarp to the south of Guyra Plain, the southerly fall of New England to the Peel Valley, the northerly fall of the Blue Mountains to Mudgee-Cassilis, and the southerly fall of that mass to Lake George Plains, near Goulburn. These features vary in direction, but all serve to break the continuity of slope along the Main Divide. In addition to these, there are slopes associated with the peripheral depressions; these will be noted separately.

Growth of the Plateau.

Turning now to the evolution of the features which have been outlined, one has to consider two factors—erosion and tectonic action. The history of erosion can be deciphered because important elements of ancient landscapes have been preserved by flows of basalt and other lavas. This allows of the reconstruction of the pre-basalt landscape, and gives a measure of subsequent erosion, and the nature and amount of uplift. The information thus gained can be used, in turn, to define the role of peneplanation in the formation of highland surfaces, and to help elucidate stream history.

Physiographic Meaning of the Basalts.

The Tertiary eruptive rocks of the plateau may be referred to loosely as "basalts", after the predominating member of the group. In vertical range they are found from sea-level to an altitude of 5,700 feet, and in areal distribution at intervals over the whole plateau, with major and minor concentrations in New England and Monaro respectively. The flows may be divided into three groups according to topographical relations, namely: those of the coastal plain; those which conform to the present surface, and those which are anomalous with respect to modern conditions. These will be noted in order.

Basalts of the coastal plain.—So far as is known, these are confined to the coast south of the Shoalhaven River (Nowra). They occur within 300 feet of sea-level on a limited plain of variable width cut in the edge of the plateau mass, and are thus newer than the canyons of those slopes, and newer than the uplifting of that margin of the plateau. Highland basalts of the nearby region apparently pre-date the canyons, and the coastal examples are quoted separately to place them outside generalizations relating to the plateau surface.

Conformable to existing topography.—This class includes the greater part of the areal distribution. In it the basalts occur in valleys which are still occupied by streams, or the surface they have covered slopes in sympathy with modern stream basins, with the greatest elevation of lava on or near the major divides. Thus the basalts of the Monaro region covered a surface whose topography was generally similar to that of the present Eucumbene, Murrumbidgee and

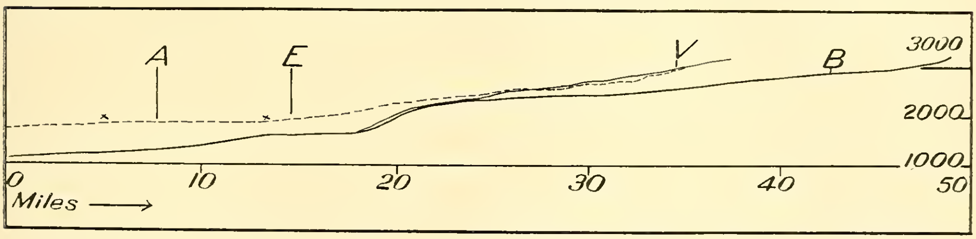
Snowy Rivers, and exceptionally high points are near the divides, or cover ancient monadnocks (e.g., Tabletop, 5,580 feet). In the case of the Macleay basin, New England, the base of the basalt falls from the divides towards the main stream junctions, and again the high points are mainly built up around ancient heights, or along persistent divides. In other places, such as Vegetable Creek, Emmaville, the flows have been separated from their immediate surroundings by later erosion, but they still lie much below the high points of the landscape at the stream heads.

Unconformable to existing topography.—The basalts of the Central Tablelands, between the Hunter Valley and Goulburn, occur largely as isolated heights on the surface of the tableland and the crests of divides, with limited extensions into high-level valleys. This is especially the case to the north of a line drawn westward from Sydney, but further south the isolated cappings give place to the greater flows of the Taralga-Goulburn district which form the highest points of that region, and include the Main Divide for a distance of 30 miles.

Relief shown by Tertiary Basalts.

From this approximate division it will be seen that the basalts of the Central Tableland occur as high features of the scenery, and vary from a little above to a little below the highest points in respective districts. On the other hand, those of New England and Monaro-Kosciusko were ejected on a surface of much higher relief, so the first conception obtained of pre-basalt conditions is one of relatively high northern and southern country separated by a lower middle stretch.

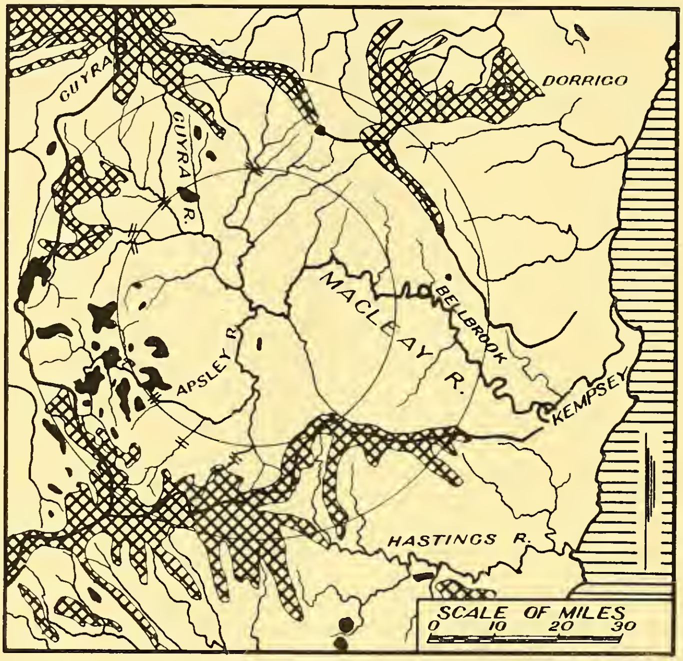
In estimating this past relief, as in any general discussion, the base of the basalt is referred to. In some instances this base lies on stream deposits in channels of definite grade. Outstanding examples are Vegetable Creek (New England) (Text-fig. 3), tributaries of Shoalhaven River, and the Kiandra flow



Text-fig. 3.—Talwegs of streams in the Emmaville district, from data collected by T. W. E. David. "A" is the ancient basalt-filled channel of Vegetable Creek, preserved as far downstream as "E", with subsidiary basalt-filled channels near the main line shown by small crosses. "V" is the modern grade of Vegetable Creek, and "B" that of Beardy River. For the coincidence of ancient and modern talwegs on the uplands, see David (1887, p. 59).

(south), which occupy channels showing a normal longitudinal profile. In each case, similar features have been reproduced in detail by modern streams, and the immediate relief involved is of the order of 1,000 feet. Extending such a line of argument to Monaro from district to district, it has been found that post-basaltic erosion above the modern altitude of 2,500 feet has been devoted to the re-development of earlier features and stream profiles in detail, thus giving a maximum pre-basalt relief of 3,500 to 4,500 feet above the lowest basalts of the region, with no probability of great differentiation of altitude during uplift (Craft, 1933). This is a conservative estimate, as the major pre-basalt features of the neighbouring Shoalhaven Valley are 500 feet lower still, again without great probability of later change.

Conditions in New England are best inferred from a study of the Macleay River (Text-fig. 4). Its upper drainage is almost perfectly enclosed by a circle of radius 35 miles and centre at the junction of Apsley River with the main



Text-fig. 4.—Macleay River basin, with basalt cross-hatched or black, and major waterfalls shown by double lines. The circles are centred at the junction of Apsley River with the main stream, and have radii of 22 and 35 miles respectively.

stream, and large tributaries flow inwards towards this centre. Within it (i.e., west of the latitude of Bellbrook) 70% of the enclosing divide is of basalt, but in each portion other rocks rise at intervals to the crest of the basalts, or a little higher. From this rimming watershed, 4,000 to 5,000 feet above sea-level, there is a centripetal fall, of the order of 800 feet per 15 miles measured in the *general* direction of the streams, and a line of cataracts is reached at 3,000 to 3,300 feet altitude: the disposition of the basalts is in sympathy with this fall, and the various terraces or levels at 3,200, 3,500 and 4,000 feet have been largely re-exposed by the stripping of their basalt covering, with the lowest flows and gravels remaining towards the stream centre.

Further east, the basalts of Dorrigo and the Hastings ridges generally have a base about 2,000 feet above sea-level, although it is as low as 1,600 feet to the south-east of Dorrigo. Comparing this with the upper Macleay basin, the difference in basaltic altitude is of the order of 1,000 feet, and the centre of the circle referred to above is 40 miles further west than the town of Dorrigo. Now if the bases of the basalts in the two localities be compared, and an allowance made for the pre-basalt fall between them, it is unlikely that the two have been differentiated by post-volcanic uplift to a greater extent than 500 feet. As the modern course of the Macleay from the centre of the circle to Kempsey, 16 miles west of the coast, is 109 miles, this estimate might allow a comparatively low grade for the pre-basalt stream. The conclusion is that, irrespective of the absolute ages of the Macleay and Dorrigo basalts, which may be similar, the amount of later warping between the Main Divide and the coastal belt in this locality does not involve a greater vertical displacement than 500 feet. The existing relief above 2,000 feet is thus essentially older than the basalts.

This conclusion is supported to the north-west of the Macleay, where the Vegetable Creek basalts mapped by David (1887) lie in a normal channel of erosion between 2,000 and 3,500 feet altitude. Modern streams have developed similar profiles to the lower limit (Text-fig. 3), so the probability of considerable warping on this part of the western slopes is small. In this connection it is interesting to recall that Andrews (1904) placed the major extrusions of the region in the first part of the "canyon period", and both he and David (1887) quoted instances where canyon streams towards the western limits of these highlands have not yet cut through basalt-filled channels, the recorded instances being at a modern altitude below 2,000 feet.

Turning now to the Central Tableland, between the Hunter Valley and Goulburn, essentially different conditions are met. As a general rule, the isolated drifts and basalts occur in valleys not more than 500 feet in depth, and some flows on the northerly divides of the Colo are based on isolated points equivalent to the highest level of the nearby sandstone surface. The base of the flows in various districts indicates variable local relief: this has a minimum value of 500 feet towards the north in the Colo basin, a rather similar value in the central portion about Jenolan, and in the southern about Taralga, and a value of 800 feet in the south-east between Moss Vale and the middle Shoalhaven; half of the latter figure seems to be due to uplift immediately preceding the basalts. Arguing solely from this, a general relief of 500 feet may be ascribed to the Blue Mountains portion of the pre-basalt surface, and a possible altitude of 1,000 feet above sea-level, with such ancient residuals as Mt. Lambie rising almost to 2,000 feet. There is another factor in addition to those mentioned, as the base of the basalt varies greatly from district to district: characteristic altitudes are 3,500 feet (Colo divide), 3,000 feet (Grose basin), 4,000 feet (Shooter's Hill), 3,800 to 3,000 feet (Mt. Werong to Abercrombie River), 2,700 feet (Taralga), 2,000 to 2,400 feet (eastern Wollondilly, Craft, 1928, p. 642). Now the surface on which these flows rest has been deformed to the extent indicated by these figures since the deposition of the Triassic rocks, and the question arises: Was this deformation earlier or later than the basalts? Up to the present, the evidence has been construed to gain the answer, "later", and it would be difficult to arrive at any other conclusion when the relationships of the canyons intersecting the basalts of the Wollondilly, Shoalhaven and Grose River districts are studied. If this answer also applies to the more northerly section, there has been tilting or faulting towards the low country of the Hunter-Castlereagh districts, but the possibility of greater earlier elevation in that area has yet to be investigated.

In conclusion of this section it may be stated that, at the time of basaltic extrusion, the Central Plateau or Blue Mountains formed a low region between the higher masses. Its general elevation probably did not exceed 1,000 feet, with a maximum of 2,000 feet, whilst the higher mass of New England rose to 3,500 feet, and the Monaro-Kosciusko region to 4,500 or 5,000 feet as a maximum. There appears to have been little subsequent deformation in the higher regions, but the Central Plateau may have been warped considerably.

Changes of Elevation shown by Basalts.

The changes deduced from basalt occurrences depend on the presence of underlying terrestrial stream deposits, and the consequent assurance that the land surface affected was above sea-level in basaltic times. It has been suggested that the presence of the stream gravels indicates widespread subsidence (e.g., Andrews, 1910*c*), but existing streams have deposited gravels at similar grades, and the channel gradient, arrangement, and other local features of various deposits make the possibility of general subsidence very remote. Changes involved are thus due to movements of uplift, except on the littoral, where there is evidence of both uplift and subsidence with respect to present sea-level, movement in either direction being of the order of 200 feet. For the plateau surfaces, the changes of elevation inferred are based on this discrepancy between pre-basaltic profiles and those of the present day; the eastern side is used in preference to the western, as it is based on sea-level, while the western base-level on the edge of the plateau is 500 to 600 feet higher. There is no way of telling how this latter has varied within a relevant period, as any change of slope due to uplift has been too slight to allow of the development of distinctive new features on the inland plains.

Examining the plateaus in detail, it is found that there are three major areas where the basalt-flows come near sea-level, namely, Brisbane and Richmond River (350 and 0 feet altitude respectively), the Hunter-Castlereagh area (700 feet near Merriwa), and the south coastal plain between Nowra and Eden (up to 300 feet). In the first example, the total movement is small; in the second, uplift is limited to the order of 500 feet, which is also the depth of gullies below basalt-filled channels, and the third example post-dates the canyons, and sets a local limit to most recent uplift of the order of 300 feet. Elsewhere, canyons have been eroded below the basalt lines to the depth of 2,000 feet in the Clarence, Macleay and Hastings basins of the North Coast, in the Blue Mountains, and in the southern tableland, especially in the case of Shoalhaven River. To the west of the Main Divide, similar gorges rarely exceed 1,000 feet in depth except in the fall to Murray River, in the edge of the higher Kosciusko mass. As the higher features approach the coast and are thus exposed freely to erosion from base-level, it may be granted that 2,000 feet represents the general magnitude of post-basaltic uplift in the main plateau masses quoted, and there are intermediate and bordering areas where it has been much smaller, namely, Darling Downs, the Richmond and lower Clarence basins, the Hunter-Cassilis-Castlereagh area, the Sydney basin and the lower Clyde. All of these may be considered as relatively stationary areas.

These considerations also disclose the main parts affected by warping, which comprise the surroundings of the Richmond-Clarence, Sydney and Clyde River areas, the northern and western fall of New England, the northern and southern slopes of the Blue Mountains, and the slopes on either side of the Shoalhaven-Monaro-Kosciusko plateau. This is already well recognized on the evidence of tilted rocks or inclined planes of erosion, but it must be emphasized that the tilting involved has been only a portion of the gentler regional slopes referred to earlier, whose total rarely exceeds 1°, and the steeper tableland edges are separate erosional features. Where basalts occur on the inclined surfaces of the main plateaus in the warped zones, as on the northern slope of New England (Queensland) to the Darling Downs and the fall of the Blue Mountains south of Jenolan, it is assumed that they have shared the general warping. Where they cover channels of normal stream profile, especially where these have been re-developed in more modern times, as on the slopes at Vegetable Creek, the Macleay basin, Shoalhaven River and Kiandra, the general fall of the surface (i.e., the whole general angular value up to 2°) is of erosional origin. Reid's sections of the northerly fall of the basalts from New England do not conflict with the details of this interpretation, but if it should be shown that those basalts occupy unwarped channels of normal profile, it will be necessary to grant a pre-basaltic relief for northern New England approximating to that of the present day, as he contends (1926, pp. 304–305), instead of allowing later uplift of 2,000 feet to complete the existing relief in that area.

Age of Peneplanation.

Having given an indication of pre-basalt relief and the extent of later movements of uplift, it remains to be seen whether an earlier form of the landscape can be deduced. The only relevant evidence appears to be offered by the relationships between the sub-horizontal Mesozoic or earlier rocks, and the older masses which they flank. The most complete reduction appears to have taken place in the Blue Mountains, where the surface of unfolded Mesozoic or Permian rocks gives place to planes cut in granites or older folded strata with very little change of altitude in the passage. That this relationship is ancient is shown by the line of hard residuals, or monadnocks, which extends over a distance of 150 miles between the Mudgee and Goulburn districts. These points rise from 300 to 600 feet above the newer rocks on their flanks, and were residuals at the close of the Triassic period, indicating that the older rocks had been planed down to approximately their present surface at that time.

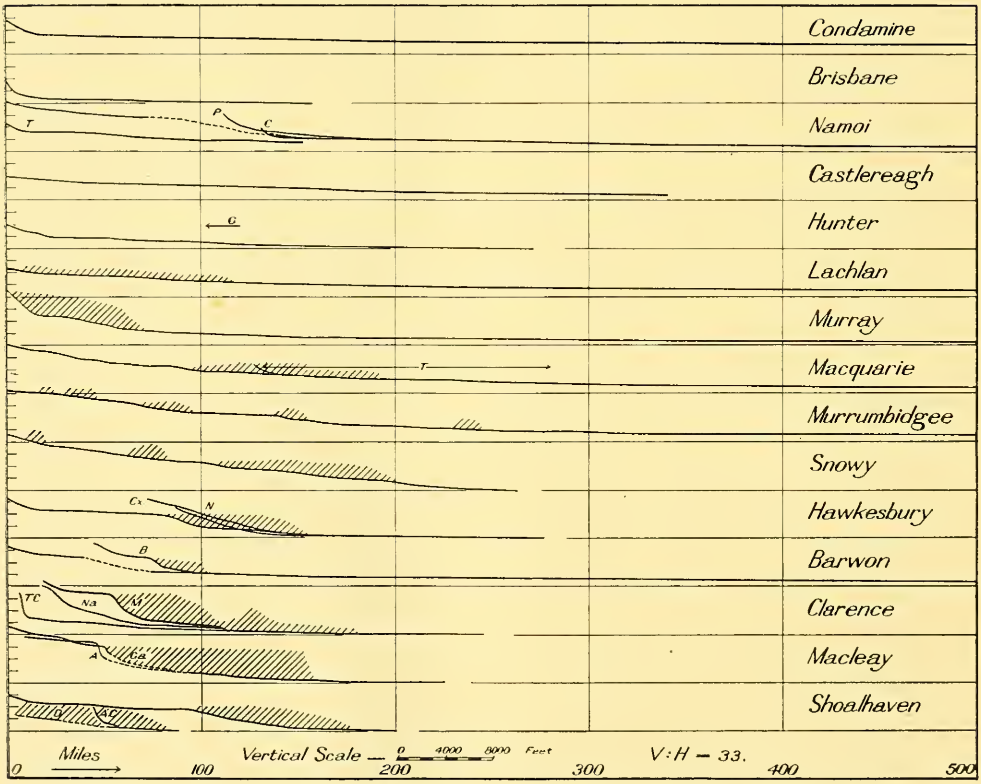
In the Shoalhaven-Monaro region there is evidence that the upper surface of the Triassic-Permian strata is continuous with a peneplain in the older bounding rocks. Different action by combined uplift and erosion may have given the essentials of the existing landscape above the (modern) height of 3,000 feet by the end of the Mesozoic era, while that above the modern altitude of 2,000 feet was developed before the period of Tertiary basalts (Craft, 1932, 1933). New England is still more difficult to discuss, as the intrusion of granites and concomitant uplift appear to have survived into the Mesozoic. The central mass is flanked by Mesozoic rocks which are very rarely above 2,000 feet in altitude; where the passage from newer to older strata is not marked by wide valleys—such as the Hunter and Peel—there is a sharp rise to the older mass, which thus appears as a low dome partly enclosed by the more recent surface. It is impossible to say precisely whether this area was ever reduced to form an approximately horizontal plane, but something of the kind may have taken place, as the course of newer movements has been to elevate the central mass, while neighbouring areas have had their persistent basin form renewed or accentuated.

Summing up, it may be concluded that the most complete peneplanation recorded in the history of existing land forms is in the region of the Blue Mountains, where monadnocks are comparatively insignificant points. The New

England and Monaro-Kosciusko regions have been domed gently, with a considerable proportion of the movement being post- and pre-Mesozoic respectively. The highlands thus formed have been subjected to continuous invasion, and incomplete peneplains have been eroded; these are shallow basins of erosion in the north and great terraces in the south, which lead to higher cores of gently convex aspect in each case. Present erosion from east and west is tending to impose a sinusoidal curve in section from east to west throughout the length of the highlands.

Streams of the Plateau.

Classification.—On the basis of present knowledge, a stream classification can be made by reference to profiles and canyon relationships. Three major types may be recognized, namely, (i) one in which a profile of equilibrium exists, without notable canyon sections even in the headwater trace; (ii) one in which a profile of equilibrium has been attained, with appreciable canyon sections; and (iii) one in which there is a torrent section, and juvenile canyons apart from the headwater tract, the torrent section usually occurring between graded upper and lower courses (Text-fig. 5). These may be taken in order.



Text-fig. 5.—Stream Profiles (talwegs) of representative streams. Shading indicates canyon sections, and the letters stand for the following river names: P. = Peel; C. = Conadilly; T. = Talbragar (to Macquarie); G. = Goulburn; Cx. = Cox; N. = Nepean; B = Beardy; T.C. = Tooloom Creek; Na. = Nymboida; M. = Mann; A. = Apsley; Ga. = Guyra; D. = Deua; A.C. = Araluen Creek. The principal lengths are by courtesy of the Lands Department.

(i) *Examples*: Condamine, Lockyer's Creek, Brisbane River, Conadilly, Peel, Castlereagh, Talbragar, Goulburn-Hunter.

These have talwegs with slight upper concavity, and almost the whole of each course is heavily alluviated, the maximum width of flats for a single stream being 16 miles in the valley of Conadilly River above Gunnedah. The banks of the Condamine, Brisbane and Hunter are steep in places where they pass through or near hard rocks, and local hills rise some hundreds of feet above them. However, the general topography is that of wide, shallow valleys or interior plains, with smooth surfaces favouring the operation of sheet floods. Such conditions are found almost to the heads; thus the Condamine rises in flat valleys dominated by scattered buttes, Lockyer's Creek in the basalt scarp of Darling Downs, and the Conadilly in the northern scarp of Liverpool Range, but in each case the flow is directly on to plains. The upper Peel and the Hunter occupy trough-like valleys with rounded and conical hills respectively rising above them, while the Goulburn Valley has steep sides and a more pronounced grade for part of its course, although it can hardly be included in the following class.

(ii) *Examples*: (*a*) Lachlan, Murray; (*b*) Macquarie, Murrumbidgee, Snowy; (*c*) Hawkesbury (Nepean, Cox, Colo, Macdonald).

The first two examples have talwegs rather similar to those of the first type: the Lachlan has a long, shallow gorge section above Cowra, while the Murray falls steeply in gorges and narrow valleys to 3,000 feet in depth, and its upper valleys consist of alternating basins and constrictions of the gorge sides. Neither stream flows over any considerable area of high plateau, but each has eliminated major waterfalls from its bed, and has established an approximate equilibrium, with a slight general tendency towards downcutting.

These streams are not so well known as the following three, Macquarie, Murrumbidgee and Snowy, which have a generally concave talweg, although the upper portion of each is distinctly convex, with many irregularities. The upper course of the Murrumbidgee and (Eucumbene)-Snowy have alternate basins and constrictions: the basin floors are plain interior features, with considerable alluviation, from which the streams pass into constrictions without a general steepening of grades. The constrictions have sides up to 50° in slope, and in parts the whole space between them is occupied by the river bed. Lower down their courses, at Burrinjuck in the case of the Murrumbidgee and below Bombala on the Snowy, the streams flow through gorges, whence they pass to the lower plain sections. Each of these rivers has been so well adjusted to local conditions that in the first 150 miles of its course there has been an almost uniform downcutting of 100 to 200 feet since the period of basalt flows. The third stream of the group, Macquarie River, lacks the basins and constrictions towards its head, and flows in undulating land of varying relief, which includes valleys 1,000–1,400 feet deep in the fall towards the Bathurst Plains. Below that feature, the river passes into hilly country, with sections of canyons down to 1,000 feet below the local plateau level, whence it flows to the inland plains.

In the Hawkesbury group many topographical features are due to the presence of jointed sub-horizontal sandstones, which give convex profiles in the gorge units of the Macdonald, lower Colo, and Nepean basins, and precipitous cliffs in the broader valleys of the upper Colo, Grose and Cox-Wollondilly Rivers. These wider upper valleys differ from the basins of the Snowy and Murrumbidgee in being strictly localized, and having wide floors trenched by canyons of varying depths. With each there is a single major constriction where the dipping Triassic sandstones are crossed in the passage to the Sydney basin.

(iii) *Examples*: Barwon, Gwydir, Namoi, Clarence, Macleay, Wollondilly and Shoalhaven Rivers.

This type differs from the preceding in having greater lengths of canyons, and a torrent tract including major rapids and waterfalls. The headwater section has a concave talweg, and the river grade below the steep middle fall is comparatively gentle, although the streams are usually turbulent, and cross many bars of hard rock. Approaching the edge of the highlands, the canyons widen and give place to valleys of decreasing depth, and to plains as the highland edge is passed.

Considering the examples in detail, it is found that the rivers of New England west of the Main Divide flow through gentle valleys between plateau ridges until they come within 2,500 or 2,000 feet of sea-level, when they fall further into canyons 500 to 1,000 feet in depth, and finally emerge on level valley floors in piedmont plains about 1,000 feet above sea-level. The eastern streams of New England have a higher fall line, about the altitude of 3,000 feet; from this level they fall into canyons to 2,500 feet in depth, whence they pass to the plains. Thus the Clarence flows into a peripheral depression and has gentle grades and open valleys in the Mesozoic rocks about Grafton, but the western tributaries, Timbarra, Mann and Boyd Rivers, flow in great canyons with a maximum depth of 2,500 feet about Newton Boyd. A feature of the streams in these canyons, and of the neighbouring Macleay, is the turbulence of the current even at the lower grades, and the number of rock bars in each channel, although the presence of stream gravels and drift up to 50 feet above the rivers indicates a recent period of quieter flow, and presumably of lesser erosion. The headwater portions of many of the upper Clarence streams are found in a strip of undissected plateau 20 miles in width; this is reminiscent of the upland basin of the Macleay which has already been mentioned (section on basaltic relief).

In others of the coastal rivers, the Richmond and Manning especially, more than half of each course is less than 500 feet above sea-level. They differ from the Clarence and Macleay in the virtual absence of higher level plateau from their heads, and in the presence of numerous steep canyons. In the south, the Clyde, Deua and Tuross are rather similar to these, and complete profiles cannot be drawn for them at present.

Towards the south, the Wollondilly and Shoalhaven differ from the northern streams in matters of detail. In both cases the graded upper section consists mainly of level plains bounded by higher ridges or plateaus, and the lower part of each is in a precipice-crowned valley or canyon. The streams in the south, like the Clarence and Macleay in the north, show the headward progression of a rejuvenating movement by the extension of canyons into uplands, and by sharp fall lines. On the western side of the Main Divide, similar phenomena are only seen in certain rivers draining the western slope of New England, and the other stream courses have a much more ancient aspect, even in the case of the deep gorge of the Upper Murray (Kosciusko) area, where the steep head falls begin close to the divides. However, there has been revival here at some time since the basaltic period, as the Tumut River flows in a gorge cut more than 2,000 feet through basalts and "leads", and the Macquarie at Bathurst flows more than

500 feet below a similar occurrence. It should be noted that basalts of the Tumut divide extend southward to the Murray valley at 1,300 feet, so revival does not necessarily mean uplift in that section.

In addition to the characteristics already mentioned, there are some common to all of the rivers. Deposits of coarse gravel overlain by finer drift or silt occur at all altitudes, and on grades as steep as 1:50. They are not common in narrow canyons where the streams pursue torrential courses, but even here they are found occasionally up to 100 feet above the present stream beds, and they occur freely on the gentler gradients of gorges and narrow valleys. Three stages may be recognized as affecting them: firstly, streams flowed in rock channels, and transportation of debris tended to exceed accumulation; secondly, there was a great accumulation of coarse gravels except under very unfavourable circumstances, ranging from sea-level to the Murray-Kosciusko plateau, especially on the level plains of interior features; this was succeeded by a deposit of fine drift and silt. Thirdly, and most recently, there has been a general erosion of channels in all these deposits, which is still proceeding: on steeper grades and along more turbulent streams they have been cut through and the old rock beds re-exposed to attack; on plains, the streams flow partly on them, or are in the process of cutting channels in level surfaces. This may point to general hydrographic changes following upon changes in the amount, nature or seasonal distribution of rainfall. At the present time the rivers are also liable to great seasonal changes in volume and to floods.

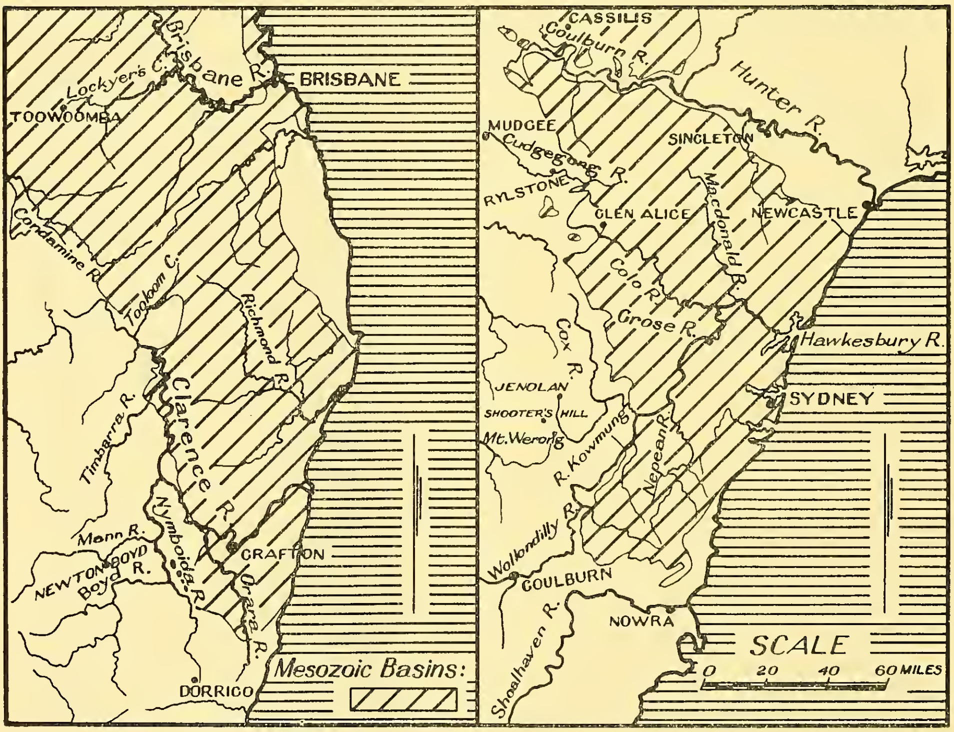
In conclusion of the section, it may be remarked that the three stream classes adopted are sufficiently representative to comprise all the streams from the highlands. So far as the plateau is concerned there is no essential difference between rivers flowing to the Pacific coast, and those flowing inland, and differences of such details as canyon depths are mainly brought about by the base level at the western edge of the highlands being 500 or 600 feet above that of the eastern, which is sea-level. This factor also affects the vertical distance through which the respective plateau edges fall, though not the value of individual slopes, and makes the gradients of western streams more uniform than they would otherwise be. There are, however, no essential differences that would enable the plateau streams west of the Main Divide to be classed separately from the eastern; all present an aspect of stability and adjustment to their various environments, or this adjustment is taking place by regrading following a process of rejuvenation.

Plan of the Systems.—The general stream arrangement of New South Wales and relevant portions of adjoining States depends on the long-continued existence of four major depressions or basins, occupied respectively by the Darling and Murray Rivers on the west, and by the Brisbane-Clarence and Hunter-Hawkesbury systems on the east of the Main Divide. The western examples are marked by the presence of symmetrical river systems, but such a condition is less apparent on the east, where more restricted areas and relatively greater variety of structure and elevation impose special local conditions on streams. The river heads in plateaus do not flow immediately towards the centres of respective basins, or toward the coast in the case of independent streams, but generally pursue meridional courses for distances up to 80 miles, measured in a straight line, before they turn away to flow eastward or westward.

The stream details of the plateaus have been largely determined by the grain of the country, the presence of specially resistant features, and the persistence of ancient slopes. All three factors operate in the Monaro-Kosciusko region, where they have determined the restricted meridional courses of the Shoalhaven, Murrumbidgee, Cotter, Goodradigbee, Tumut and Indi Rivers, and parts of the Snowy. In New England, streams of the Macintyre, Gwydir and Namoi Rivers have a general trend to the north-north-west in sympathy with the grain of the country, and similar causes have influenced the meridional tributaries of the Clarence.

It might be noted here that the relative unimportance of southward flowing streams from the southern slopes of New England may be due to the extra elevation of that edge through the development of the Hunter Boundary fault; pending agreement on the age of that feature, the matter cannot be discussed with assurance, as the whole of the high divides immediately north of the Hunter valley are concerned in the faulting movements.

When the rocks of the landscape are more homogeneous, the streams take on a symmetrical character: the Macleay, Hastings and Manning, and the Hunter tributaries rising about Barrington Tops are conspicuous examples, but there has been no comparable development south of the lower Shoalhaven, where the coastal rivers have only obtained a bare foothold on the plateau. As an example of the intimate relationship between rock structure, slopes and streams, the two complex eastern basins may be compared in detail (Text-fig. 6).



Text-fig. 6.—Locality Maps of the Brisbane-Grafton and Hunter-Sydney areas, showing the modern extent of Mesozoic rocks, with outliers, in black, to the east of Nymboida River, and the position of the main streams.

Comparison of Grafton and Sydney Basins:

	Grafton Basin.	*Sydney Basin.*
	i. Topography.	
A.	Northern Section—Level plateaus, interior features, and streams of the first type.	
1.	Plateau to 2,000 feet in Mesozoic rocks —general slopes from N.W. towards Richmond River and Grafton—volcanic rocks of West Moreton (Toowoomba) and Richmond River areas.	Plateau 1,500 to 2,000 feet—Mesozoic and unfolded late Palaeozoic—general slopes from N.W. and N. towards Sydney —basalts of Liverpool Range, Goulburn River and Colo basin.
2.	Faulted north-eastern margin (Brisbane River), folding (pre-basalt).	Faulted northern margin (Hunter Boundary fault).
B.	Middle Section—Warped margins leading down to basins.	
3.	North slopes to basin from Macpherson Range.—Sandstones to 2,000 feet—overlain by basalts, to 4,000 feet.	North slopes from plateau of 1,000 feet —general depression along Macdonald river line.
4.	Western Margin—Plateau to maximum of 5,000 feet—sharp rises to west of Mesozoic rocks in the form of western valley sides higher than those to the east.	Western margin—Plateau with 4,400 feet, with Mesozoic and Kamilaroi rocks merging with surfaces of older rocks with no great changes of altitude between them—Greater part of rise is by monoclines west of Sydney, and in Jenolan Plateau.
4*a*.	No equivalent.	A series of flat-bottomed valleys on western margin of Mesozoic rocks.
5.	Southern Margin—Rise of Mesozoic rocks to 1,000 feet and continuation of a peneplain surface in older rocks.	Southern rise of Mesozoics to 2,500 feet with a surface continuing to older rocks (as in Shoalhaven Valley).
6.	Central Basin of Richmond-Clarence Plains and low plateau to altitude of 300 feet—unfolded sediments over 3,700 feet thick below Grafton—Grafton to Macleay divide = 48 miles.	Central Portion—low plateau to 300 feet, with many local plains—unfolded sediments much more than 3,000 feet thick below Sydney—Sydney to northern Shoalhaven divide = 56 miles.
C.	Southern Section—Rising plateaus.	
7.	Rise southward and westward to Macleay divides, from 2,000 to 4,500 feet—basalt flows on divides.	Southward rise continued over Shoalhaven Basin—depression near coast and surface fall to lower Clyde River.
	ii. Stream Equivalents.	
1.	Brisbane River—near junction of Mesozoic with older rocks—associated with major fault lines—Lockyer's Creek from west.	Hunter River—follows close to limits of Mesozoic rocks—associated with major fault lines—Goulburn River from west.
2.	Main Clarence—Nymboida line keeps close to western extremity of the Mesozoic rocks, and to the east of the higher mass of New England.	Wollondilly and Kowmung Rivers near western extremity of Mesozoics, and to east of higher masses of Jenolan plateau, and its southern extension.
3.	Orara River—flows N.W. in sympathy with dip of Mesozoic rocks and fall of surface.	Nepean River—flows north along general line of depression, and tributaries flow N.W. to the depression in the sandstones.
4.	Timbarra River flows northward, and Boyd and Mann systems flow as normal streams to the main Clarence-Nymboida line.	Shoalhaven River runs northward towards the centre of the basin, although it turns independently to the sea.
5.	Richmond River falls from north towards the centre of the basin as an independent system.	Colo and Macdonald Rivers follow depression to Hawkesbury.

Summing up, it is found that the topography and streams of these two areas are similar. In each case, there is a varied fall into a central depressed area, with a wide valley and a river system on the northern side. Streams flow from older to newer, sub-horizontal rocks, where their position seems to have been determined mainly by weak edges where the newer rocks join the older, by the slopes of the warped sides of the basin, and by certain tectonic features, such as very gentle synclines. The Brisbane (Marks, 1933, p. 135), Orara, Macdonald and Nepean have been quoted as examples of this latter, and it is possible that other streams have a similar origin. Thus Willan (1923, p. 24) suggested this for the lower (eastward) course of the Hawkesbury, and Carne's sections (1908) show the Grose River as flowing in a slight syncline, and the easterly course of Capertee River (Colo system) below Glen Alice as occupying the line of a depression 600 feet deep, shown in both the plateau surface or the top and bottom of the Kamílaroi (Upper) Coal Measures. The writer suggests that the ultimate stream origins in these cases are to be found in slight roughening of a virtually undenuded surface during an early phase of the uplift of the Mesozoic rocks, and to the establishment of other rivers along the marginal lines of weakness: the latter received drainage from the higher enclosing masses of older rocks. There appears to be no good evidence for extensive stream rearrangements away from the general lines of such a primitive course, and the writer believes that the existing system can be regarded as static over a long period of time, commencing before the extrusion of Tertiary lavas, although these have doubtless been responsible for local variations.

Conclusion.

1. The progress of physiographic thought and knowledge in the State is reviewed briefly. Features common to both earlier and later periods are the idea of an anticlinal Main Divide, the uniformity of structure and process in Eastern Australia, and the postulation of extensive marginal faulting. Distinctively modern ideas include those of the peneplain, and the rearrangement of stream patterns by the interaction of tectonic influences and dynamic stream action.

2. The topographic features of the New South Wales plateaus may be grouped as "exterior" or "interior" features, depending on the respective absence or presence of higher enclosing ground in a district, and a sharp break of slope where its fall meets lower features.

3. The more recent developments of the plateau can be traced by reference to old land surfaces and stream channels preserved by Tertiary lavas. These give a measure of pre-eruption relief, which is found to have been of the order of 3,000 feet in New England, and 4,500 to 5,000 feet in Monaro-Kosciusko region, with an intermediate zone of low country generally not exceeding 1,000 feet, with a few higher points. A master peneplanation is of much greater age, and only parts of the gentle upper slopes of the plateau to the east and west are due to warping following pre-basalt uplift. The plateau edges are primarily erosional features.

4. The plateau streams may be included in three classes: the first has a profile of equilibrium with no canyons; the second has such a profile with sections of canyon, and the third has a profile of rejuvenation with canyons forming a large or predominating feature in the highlands. Such characteristics as alluvial deposits are held in common.

5. The stream plan has been determined by the existence of peripheral depressions. The grain of the country, zones of hardness and ancient slopes have acted as determinants along the median of the plateau strip, to give stretches of meridional courses.

6. A comparison is made between the topography and stream positions of the eastern depressions: the Brisbane River system is equated with the Hunter, the Clarence-Nymboida with the Wollondilly, the Richmond with the Colo and Macdonald, the Orara with the Nepean, and the Timbarra, Boyd, and Mann Rivers with the Shoalhaven.

Viewed as a whole, the region has been subjected to a gentle post-basaltic uplift of 2,000 feet on the median line of the highlands, with relatively depressed portions forming Darling Downs and the low country between the Goulburn and Castlereagh Rivers. The streams are well adjusted to their environment, or are regrading parts of their channels as a result of uplift mentioned above, and new lower plains and levels are extending on the margins, forming a new terrace on either side of the higher terraced plateau mass.

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